Jingqi Huang

CONTACT INFORMATION

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EDUCATION

Purdue University, West Lafayette, Indiana USA
Ph.D., Computer Science — **May 2020 - June 2025 (Expected)**
Advisor: Chunyi Peng

University of California, San Diego, La Jolla, California USA
M.S., Eletronical and Computer Engineering — **September 2018 - March 2020**
Advisor: Xinyu Zhang

Beijing University of Posts and Telecommunications, Beijing, China
Queen Mary University of London, London, UK
B.S., Internet of Things Engineering — **September 2014 - June 2018**

HONORS AND AWARDS

2014-2017 Beijing University of Posts and Telecommunications scholarship (every year)

PUBLICATIONS

[C1] S. Wang*, **J. Huang*** (co-primary) , X. Zhang, H. Kim and S. Dey, *"X-Array: Approximating Omnidirectional Millimeter-Wave Coverage Using an Array of Phased-Arrays"*, accepted by The 26th Annual International Conference on Mobile Computing and Networking (*MobiCom 20'*), 2020.

[C2] A. Zhou, S. Xu, S. Wang, **J. Huang**, S. Yang, T. Wei, X. Zhang and H. Ma, *"Robot Navigation in Radio Beam Space: Leveraging Robotic Intelligence for Seamless mmWave Network Coverage"*, in proceedings of ACM International Symposium on Mobile Ad Hoc Networking (*MobiHoc'19*), 2019.

[C3] S. Wang*, **J. Huang*** (co-primary) and A. Zhou, *"KPad: Maximizing Channel Utilization for MU-MIMO Systems using Knapsack Padding"*, IEEE International Conference on Communications 2018 (*ICC'18*), 2018.

[J1] A. Zhou, S. Xu, S. Wang, **J. Huang**, S. Yang, X. Zhang and H. Ma, *"Robotic Millimeter-Wave Wireless Networks"*, Accepted by IEEE/ACM Transactions on Networking (ToN).

POSTERS

[P1] S. Wang*, **J. Huang*** (co-primary) and X. Zhang, *'Approximating Omni-Directional mmWave Coverage Using an Array of Phased-Array"*, UCSD 5G & Beyond Forum, 2019.

[P2] R. Zhao, S.Wang, **J. Huang** and X. Zhang, *"5G Millimeter-Wave V2X: A Reality Check"*, UCSD Research Review, 2018.

RESEARCH EXPERIENCE

Demystify performance opportunities missed in 4.9G/5G networks (Ongoing)

- Goal: Uncover data performance missed in today's 4.9G/5G networks and exploit on-device network intelligence to catch up with the missed opportunities for enhanced performance
- Conducted a city-scale measurement study to identify and characterize performance gaps between what mobile devices actually got and what mobile devices could have got at best with all four top-tier US carriers.
- Performed a preliminary root cause analysis and uncovered sub-optimal (or even worse) cell selection operation when carrier aggregation is in use (enabled in 4.5G/4.9G/5G and beyond).
- Worked on the feasibility study to adjust the default network operations for enhanced data performance in 4.5G/4.9G networks.

Demystify milimeter-wave (mmWave) vehicle-to-infrastructure (V2I) (Ongoing)

- Goal: Conduct the first measurement study of mmWave V2I to demystify its feasibility, potential and limitations.
- Designed a comprehensive experiment plan to characterize link dynamics and impacts of mmWave-specific factors such as codebook/beam management, interference, antenna geometry, etc..
- Did extensive simulations with traffic models in different environment settings, including urban, suburban and highway over *Simulation of Urban Mobility* (SUMO) and *Wireless Insite*.
- Validated mmWave's capability to provide stable links at a speed over 60 mph in real experiments.

Enable WiFi-like coverage in mmWave networks

- Goal: Enable WiFi-like omni-drectional coverage to mmWave networks via an access point with Array of Phased-Arrays (APA).
- Proposed the first optimization-driven array/beam selection algorithm tailored to APA to maximize the link quality under power constraints.
- Designed a low-overhead *dynamic co-phasing algorithm* to predict and compensate the phase offset change between multiple transmit antenna arrays.
- Designed a link recovery mechanism to efficiently and accurately find alternative arrays or beams when the strong path disappears (blockage) or reappears under highly directional mmWave.
- Conducted extensive experiments to validate effectiveness of our proposed design.

Enable seamless mmWave coverage with a robot relay

- Goal: Overcome the coverage limitation of mmWave to provide seamless room-level mmWave coverage using a robotic relay.
- Designed novel algorithms to reconstruct the outline of the environment and recover the propagation of the signal path using measured RSS.
- Designed an adaptive path planning algorithm to navigate the robot relay in real-time and statistically maximize network performance under the client's self-blockage and environmental dynamics.
- Implemented our design on a programmable robot, integrated with COTS 802.11ad radios and validated its effectiveness with nearly full coverage for an office environment.

Enable robust mmWave link using model-driven beam steering

- Goal: Improve mmWave network's low robustness under mobility and blockage with a model-driven beam steering method.
- Employed a reverse-engineering approach to reconstruct spatial channel profiles (SCPs) at new locations using their correlations, without brute-force beam scanning.
- Designed a blockage-resilient beam prediction mechanism over the optimization model, to maintain high performance with concurrent mobility and blockage.
- Proposeed a greedy approximation algorithm to reduce computational overhead involved with the reverse-engineering for user tracking, achieving real-time beam steering.
- Evaluated our design using a reconfigurable 60 GHz testbed along with a trace-driven simulator and validated multi-fold throughput gain compared with the state-of-the-art.

Approximate maximum channel utilization for MU-MIMO systems

- Goal: Make full use of the idle channels caused by frame size diversity in MU-MIMO by padding extra users' frames closely after short frame transmissions.
- Formulated the user padding problem via a *multi-stream knapsack model*, a variant of the classical knapsack model.
- Designed *KPad*, an algorithm to schedule padding users with a greedy stream decoupling.
- Validated the performance gain (up to 42%) of KPad using trace-driven emulation with 50 user traces collected by WARP SDR.

Skills

- Languages: C, Java, C++, Python, Matlab, HTML/CSS, Shell, mySQL, Assembly, LaTeX
- Platforms: Linux, MacOS, Windows